Reference List

Abu Hammad, A., & Tumeizi, A. (2012). Land degradation: socioeconomic and environmental causes and consequences in the eastern Mediterranean. Land Degradation & Development, 23(3),216-226.

Agarwal, K., Singh, I., Sharma, M., Sharma, S., & Rajagopalan, G. (2002). Extensional tectonic activity in the cratonward parts (peripheral bulge) of the Ganga Plain foreland basin, India. International Journal of Earth Sciences, 91(5), 897-905.

Agarwal, R., Garg, P. K., & Garg, R. D. (2013). Remote sensing and GIS based approach for identification of artificial recharge sites. Water resources management, 27(7), 2671-2689.

Agnese, C., D'Asaro, F., Grosso, G., Rosso, R. (1996). Scaling properties of topologically randomchannel network. J Hydrol 187:183–193

Ahmad, E. (1968). Distribution and causes of gully erosion in India, 21st International Geographical Union Congress (N. Delhi) Selected Papers 1, l-3.

Ahmad, E. (1973). Soil Erosion in India. Asia Publishing House, Bombay.

Alexander, D. (1982). Difference between "calanchi" and "biancane" badlands in Italy. In: Bryan,R., Yair, A. (Eds.), Badland Geomorphology and Piping. Geo Books, Norwich, UK, pp. 71–88.

Alexander, R.W., & Calvo, A., (1990). The influence of lichens on slope processes in some Spanish badlands. In: Vegetation and Erosion. Wiley, Chichester, pp. 385–398.

Alexander, R.W., Harvey, A.M., Calvo, A., James, P.A., Cerda, A., (1994). Natural stabilization mechanisms on badland slopes: Tabernas, Almeria, Spain. In: Millington, A.C., Pye, K. (Eds.), Environmental Change in Drylands: Biogeographical and Geomorphological Perspectives. John Wiley & Sons Ltd.

Allison, F. E. (1973). Soil Organic Matter and its Role in Crop Production. Elsevier Science Publ.,New York.

Alonso-Sarria, F., Romero-Díaz, A., Ruíz-Sinoga, J. D., & Belmonte-Serrato, F. (2011). Gullies and badland landscapes in Neogene basins, region of Murcia, Spain. Landform Analysis, 17, 161-165.

Alqahtani, F., & Qaddah, A. A. (2019). GIS digital mapping of flood hazard in Jeddah–Makkah region from morphometric analysis. Arabian Journal of Geosciences, 12(6), 1-20.

Anbarasu, A. (2001). Facies variation and depositional environment of Mesoproterozoic Vindhyansediments of Chitrakut Area, Central India. Journal of Geological Society of India (Online archivefrom Vol 1 to Vol 78), 58(4), 341-350.

Andersson, S., Nilsson, S. I., & Saetre, P. (2000). Leaching of dissolved organic carbon (DOC) and dissolved organic nitrogen (DON) in mor humus as affected by temperature and pH. Soil Biology and Biochemistry, 32(1), 1-10.

Aown, A., & Kar, N. S. (2016). Lateritic badland of Sinhati, Bankura, West Bengal: a geomorphicinvestigation. In Neo-thinking on Ganges-Brahmaputra Basin geomorphology (pp. 19-31). Springer, Cham.

Appelo, C. A. J., & Postma, D. (1993). Geochemistry, groundwater and pollution, AA Balkema. Brookfield, VT.

Ariza-Villaverde, A. B., Jiménez-Hornero, F. J., & De Ravé, E. G. (2015). Influence of DEM resolution on drainage network extraction: A multifractal analysis. Geomorphology, 241, 243-254.

Ariza-Villaverde, A. B., Jiménez-Hornero, F. J., de Ravé, E. G., 2013. Multifractal analysis applied to the study of the accuracy of DEM-based stream derivation. Geomorphology, 197, 85- 95.

Avouac, J. P., & Burov, E. B. (1996). Erosion as a driving mechanism of intracontinental mountaingrowth. Journal of Geophysical Research: Solid Earth, 101(B8), 17747-17769.

Bagyaraj, M., Gurugnanam, B., & Nagar, A. (2011). Significance of morphometry studies, soil characteristics, erosion phenomena and landform processes using remote sensing and GIS for Kodaikanal Hills, a global biodiversity hotpot in Western Ghats, Dindigul District, Tamil Nadu, South India. Research Journal of Environmental and Earth Sciences, 3(3), 221-233.

Bai, Z., Xu, Y. P., Gu, H., Pan, S., 2019. Joint multifractal spectrum analysis for characterizing the nonlinear relationship among hydrological variables. Journal of Hydrology, 576, 12-27.

Baioni, D. (2007) Drainage Basin Asymmetry and Erosion Processes Relationship through a NewRepresentation of Two Geomorphic Indices in the Conca River (Northern Apennines). Italian Journal of Geosciences, 126, 573-579

Bali, R., Agarwal, K. K., Ali, S. N., Rastogi, S. K., & Krishna, K. (2012). Drainage morphometry of Himalayan Glacio-fluvial basin, India: hydrologic and neotectonic implications. EnvironmentalEarth Sciences, 66(4), 1163-1174.

Bao Le, Q., Nkonya, E., & Mirzabaev, A. (2014). Biomass productivity-based mapping of globalland degradation hotspots (No. 193). ZEF Discussion Papers on Development Policy.

Battaglia, S., Leoni, L., & Sartori, F. (2003). Mineralogical and grain size composition of clays developing calanchi and biancane erosional landforms. Geomorphology, 49(1-2), 153-170.

Begin, Z.B., Meyer, D.F. and Schumm, S.A. (1981). Development of longitudinal profiles of alluvaial channels in response to base level lowering. Earth Surface Processes and Landforms, 6:49-68.

Bengtson, S., Belivanova, V., Rasmussen, B., & Whitehouse, M. (2009). The controversial “Cambrian” fossils of the Vindhyan are real but more than a billion years older. Proceedings of the National Academy of Sciences, 106(19), 7729-7734.

Benito, G., Gutierrez, M., Sancho, C. 1993. Erosion rates in badland areas of the Central Ebro basin (NE-Spain). Catena 19, 269–286.

Benito, G., Gutierrez, M., Sancho, C., 1993. The influence of physico-chemical properties on erosion processes in badland areas of the Ebro basin, NE Spain. Zeitschrift für Geomorphologie 37, 199–214.

Bennett, S. J., Alonso, C. V., Prasad, S. N., & Römkens, M. J. (2000). Experiments on headcut growth and migration in concentrated flows typical of upland areas. Water Resources Research, 36(7), 1911-1922.

Berndtsson, R. (1988). Spatial Hydrological Processes in a Water Resources Planning Perspective. An Investigation of Rainfall and Infiltration in Tunisia. University of Lund. Report no. 1009, 315pp.

Bhatt, S. C., Singh, R., Ansari, M. A., & Bhatt, S. (2020). Quantitative Morphometric and Morphotectonic Analysis of Pahuj Catchment Basin, Central India. Journal of the Geological Society of India, 96(5), 513-520.

Bhattacharyya, A. (1996). Recent advances in Vindhyan geology.

Bors-Oprişa, S. (2011). Research aspect of the study and degraded slopes with erosion control vegetation under Somes Plateau, PhD thesis USAMV Cluj-Napoca

Bouma, N.A. (2006). Rill Initiation and Development in Relation to Dynamic Soil Properties (Ph.D. thesis). University of Amsterdam. F&N Eigen Beheer, Amsterdam.

Brady, N.C., & Weil, R.R.(2002). The Nature and Properties of Soil. Prentice Hall, Upper SaddleRiver, NJ, p. 960.

Braga, J.C., Martín, J.M., Quesada, C. (2003). Patterns and average rates of late NeogeneRecent uplift of the Betic Cordillera, SE Spain. Geomorphology 50, 3–26.

Bridge, B.J., & Tunny, J. (1973). The effect of gypsum treatment on the swelling of natural clodsof a clay soil. Soil Science 115 (6), 414–419.

Brown, J. A. H. (1972). Hydrologic effects of a bushfire in a catchment in south- eastern New South Wales, J. Hydrology, Vol.15, pp.77-96.

Brown, J.H., Gupta, V.K., Li, B.L., Milne, B.T., Restrepo, C., West, G.B., 2002. The fractal natureof nature: power laws, ecological complexity and biodiversity. Phil. Trans. R. Soc. Lond. B. 357,619–626.

Bryan, R.B., & Yair, A. (1982). Badland Geomorphology and Piping. Geo Books, Norwich, p. 408.

Bull JL, & Kirkby JM (2002). Channel Heads and Channel Extension, Dryland River, Hydrologyand Geomorphology of Semi-Arid Channels. Wiley, Chichester: 263-287.

Bull WB, & McFadden L (1977). Tectonic geomorphology north and south of the Garlock fault, California. In Geomorphology in Arid Regions. pp 115-128.

Bull, W. B., McFadden, L. D., & Doehring, D. (1977). Geomorphology in arid regions.

Butzer, K. W. (1971). Fine alluvial fills in the Orange and Vaal basins of South Africa. In Proceedings of the Association of American Geographers (Vol. 3, pp. 41-48). Association of American Geographers.

Calvo-Cases, A., & Harvey, A.M. (1996). Morphology and development of selected badlands in southeast Spain: implications of climate change. Earth Surface Processes and Landforms 21, 725–735.

Campbell, I.A. (1989). Badlands and badlands gullies. In: Thomas, D.S.G. (Ed.), Arid Zone Geomorphology. Wiley, London, pp. 159–183.

Campbell, I.A. (1997). Badlands and badland gullies. In: Thomas, D.S.G. (Ed.), Arid Zone Geomorphology: Process, Form and Changes in Drylands, second ed. John Wiley & Sons Ltd., pp. 261–291.

Cantón, Y., Domingo, F., Solé-Benet, A., & Puigdefábregas, J. (2001a). Hydrological and erosionresponse of a badlands system in semiarid SE Spain. Journal of Hydrology, 252(1-4), 65-84.

Cantón, Y., Solé-Benet, A., de Vente, J., Boix-Fayos, C., Calvo-Cases, A., Asensio, C., & Puigdefabregas, J. (2011). A review of runoff generation and soil erosion across scales in semiaridsouth-eastern Spain. Journal of Arid Environments 75, 1254–1261.

Cantón, Y., Sole-Benet, A., Queralt, I., & Pini, R. (2001b). Weathering of a gypsum-calcareous mudstone under semi-arid environment at Tabernas, SE Spain: laboratory and field-based experimental approaches. Catena 44, 111–132.

Cao, J., Tang, G., Fang, X., Liu, Y., Zhu, Y., Li, J., & Wagner, W. (2020). Identification of ActiveGully Erosion Sites in the Loess Plateau of China Using MF-DFA. Remote Sensing, 12(3), 589.

Caraballo-Arias, N. A., Conoscenti, C., Di Stefano, C., Ferro, V., & Gómez-Gutiérrez, A. (2016). Morphometric and hydraulic geometry assessment of a gully in SW Spain. Geomorphology, 274,143-151.

Cardy, F. (1994). Desertification. Our Planet, 6(5), 4.

Carmona, C. P., Ro¨der, A., Azca´rate, F. M., & B. Peco. (2013). Grazing management or physiography? Factors controlling vegetation recovery in Mediterranean grasslands. Ecological Modelling 251: 73–84.

Carrillo-González, R., Šimůnek, J., Sauve, S., & Adriano, D. (2006). Mechanisms and pathways of trace element mobility in soils. Advances in agronomy, 91, 111-178.

Casagrande, A. (1948). Classification and identification of soils. Transactions of the American Society of Civil Engineers, 113(1), 901-930.

Cencini, M., Cecconi, F., & Vulpiani, A., (2010). Chaos: from simple models to complex systems.series on advances in statistical mechanics. World Scientific. 17, 482p.

Cerdà, A., & Garcìa-Fayos, P., (1997). The influence of slope angle on sediment, water and seed losses on badland landscapes. Geomorphology, 18, 77–90.

Chakraborty, C. (2006). Proterozoic intracontinental basin: the Vindhyan example. Journal of Earth System Science, 115(1), 3-22.

Chaney, K., & Swift, R. S. (1984). The influence of organic matter on aggregate stability in someBritish soils. Journal of Soil science, 35(2), 223-230.

Charadram, N., Farahani, R.M., Harty, D., Rathsam, C., Swain, M.V., Hunter, N., 2012. Regulation of reactionary dentin formation by odontoblasts in response to polymicrobial invasionof dentin matrix. Bone 50 (1), 265–275.

Chaudhary, A., Mishra, S. K., & Ashish, P. (2013). Experimental verification of the effect of slopeon runoff and curve numbers. Journals–Indian Water Resources Society.

Chen YC, Sung QC, & Cheng KY (2003). Along-strike variations of morphotectonic features in the western foothills of Taiwan: tectonic implications based on stream gradient and hypsometric analysis. Geomorphology, 56: 109e137

Chen, W., Yan, X., Zhao, Z., Hong, H., Bui, D. T., & Pradhan, B. (2019). Spatial prediction of landslide susceptibility using data mining-based kernel logistic regression, naive Bayes and RBFNetwork models for the Long County area (China). Bulletin of Engineering Geology and theEnvironment, 78(1), 247-266.

Chhabra, A., Jensen, R. V., 1989. Direct determination of the f (α) singularity spectrum. PhysicalReview Letters, 62(12), 1327.

Chiverrell, R., Harvey, A., & Foster, G., (2007). Hillslope gullying in the Solway Firth-Morecambe Bay region, Great Britain: responses to human impact and/or climatic deterioration? Geomorphology, 84, 317–343.

Chorley, R. J. (1969). The Drainage Basin as the Fundamental Geomorphic Unit, cited in Water, Earth and Man, edited by RJ Chorley.

Clarke, J. I. (1966). Morphometry from maps. Essays in geomorphology, 235-274.

Clarke, K. C., & Schweizer, D.M. (1991). Measuring the fractal dimension of natural surface usinga robust fractal estimator. Cartography and Geographic Information System, 18, 37-47.

Coleman, P.H., & Pietronero, L. (1992). The fractal structure of the universe. Physics Report, 231,311-89.

Curtin, D., Campbell, C. A., & Jalil, A. (1998). Effects of acidity on mineralization: pH-dependence of organic matter mineralization in weakly acidic soils. Soil Biology and Biochemistry, 30(1), 57-64.

Czyż, E. A. (2004). Effects of traffic on soil aeration, bulk density and growth of spring barley. Soiland Tillage Research, 79(2), 153-166.

Czyz, E. A., Tomaszewska, J., & Dexter, A. R. (2001). Response of spring barley to changes of compaction and aeration of sandy soil under model conditions. International agrophysics, 15(1).

Dahms, E., & Fritz, L. (1998). Zustandsgrenzen (Konsistenzgrenzen). In: Hiltmann, W., Stirbny, B. (Eds.), Tonmineralogie und Bodenphysik, Handbuch zur Erkundung des Untergrundes von Deponien und Altlasten. Bd. 5, Springer Verlag, pp. 98–102.

Dar, R. A., Chandra, R., & Romshoo, S. A. (2013). Morphotectonic and lithostratigraphic analysisof intermontane Karewa Basin of Kashmir Himalayas, India. Journal of mountain science, 10(1),1-15.

Darama, Y., Yılmaz, K., & Melek, A. B. (2021). Land degradation by erosion occurred after irrigation development in the Harran plain, Southeastern Turkey. Environmental Earth Sciences, 80(6), 1-18.

Das, A.K., & Mukherjee, S. (2005). Drainage Morphometry using Satellite Data and GIS in Raigaddistrict, Maharashtra. Journal of the Geological Society of India, 65,577-586.

del Prete, M., Bentivenga, M., Amato, M., Basso, F., & Tacconi, P., (1997). Badland erosion processes and their interactions with vegetation: a case study from Pisticci, Basilicata, southern Italy. Geografia Fisica e Dinamica Quaternaria, 20, 147–155.

del Prete, M., Bentivenga, M., Coppola, L., & Rendell, H., (1994). Aspetty evolutivi dei reticoli calanchivi a sud di Pisticci. Geologica Romana, 30, 295–306.

Deng, Y., Cai, C., Xia, D., Ding, S., Chen, J., & Wang, T. (2017). Soil Atterberg limits of differentweathering profiles of the collapsing gullies in the hilly granitic region of southern china. Solid Earth, 8(2), 499-513.

Denisa, H. O. R. Å., CANTOR, M., Erzsebet, B. U. T. A., & HUSTI, A. (2013). Control of Soil Erosion on Slopes by Using Dendrological Species. ProEnvironment Promediu, 6(14).

Deshmukh, D. S., Chaube, U. C., Tignath, S., & Pingale, S. M. (2011). Geomorphological analysisand distribution of badland around the confluence of Narmada and Sher River, India. Eur Water, 35, 15-26.

Deshmukh, D. S., Chaube, U. C., Tignath, S., & Tripathi, S. K. (2010). Morphological analysis of Sher River basin using GIS for identification of erosion-prone areas.

Ecohydrology & Hydrobiology, 10(2-4), 307-313.

Desir, G., & Marín, C. (2013). Role of erosion processes on the morphogenesis of a semiarid badland area. Bardenas Reales (NE Spain). Catena, 106, 83–92.

Díaz, A. R., Sanleandro, P. M., Soriano, A. S., Serrato, F. B., & Faulkner, H. (2007). The causesof piping in a set of abandoned agricultural terraces in southeast Spain. Catena, 69(3), 282-293.

Diaz-Hernandez, J.L., Yepes, J., Romero-Diaz, A., & Martin-Ramos, J.D. (2015). Features andevolution of slip structures in badlands areas (SE Spain). Catena, 135, 11–21.

Doornkamp, J. C., & King, C. A. (1971). Numerical analysis in geomorphology: an introduction.Hodder Education.

Doran, J. W., & Jones, A. J. (1996). Methods for assessing soil quality.

Doran, J. W., & Parkin, T. B. (1994). Defining and assessing soil quality. Defining soil quality fora sustainable environment, 35, 1-21.

Drożdż, S., Oświęcimka, P., 2015. Detecting and interpreting distortions in hierarchical organization of complex time series. Physical Review E, 91(3), 030902.

Duan, L., Huang, M., & Zhang, L. (2016). Differences in hydrological responses for different vegetation types on a steep slope on the Loess Plateau, China. Journal of Hydrology, 537, 356- 366.Zaharia, D., Dumitraş, A., & Zaharia, A. (2008). Specii lemnoase ornamentale. Todesco.

El Hamdouni, R., Irigaray, C., Fernández, T., Chacón, J., & Keller, E. A. (2008). Assessment of relative active tectonics, southwest border of the Sierra Nevada (southern Spain). Geomorphology, 96(1-2), 150-173.

Espinoza, L., Slaton, N. A., & Mozaffari, M. (2012). Understanding the numbers on your soil testreport. Spanish.

Falconer, K. J. (2004, January). One-sided multifractal analysis and points of non-differentiability of devil's staircases. In Mathematical Proceedings of the Cambridge Philosophical Society (Vol. 136, No. 1, pp. 167-174). Cambridge University Press.

Faniran, A. (1968). The index of drainage intensity: a provisional new drainage factor. Aust J Sci, 31(9), 326-330.

Farhan, Y., Anbar, A., Enaba, O., & Al-Shaikh, N. (2015). Quantitative analysis of geomorphometric parameters of Wadi Kerak, Jordan, using remote sensing and GIS. Journal of Water Resource and Protection, 7(06), 456.

Farifteh, J., & Soeters, R. (1999). Factors underlying piping in the Basilicata region, southern Italy.
Geomorphology, 26, 239–251.

Farley, K. A., Jobbágy, E. G., & Jackson, R. B. (2005). Effects of afforestation on water yield: a global synthesis with implications for policy. Global change biology, 11(10), 1565-1576.

Faulkner, H., (2013). Badlands in marl lithologies: a field guide to soil dispersion, subsurface erosion and piping-origin gullies. Catena, 106, 42–53.

Faulkner, H., Alexander, R., & Wilson, B. R. (2003). Changes to the dispersive characteristics ofsoils along an evolutionary slope sequence in the Vera badlands, southeast Spain: implications forsite stabilisation. Catena, 50(2-4), 243-254.

Faulkner, H., Alexander, R., Teeuw, R., & Zukowskyj, P. (2004). Variations in soil dispersivity across a gully head displaying shallow sub-surface pipes, and the role of shallow pipes in rill initiation. Earth Surface Processes and Landforms: the Journal of the British Geomorphological Research Group, 29(9), 1143-1160.

Faulkner, H., Spivey, D., & Alexander, R. (2000). The role of some site geochemical processes inthe development and stabilisation of three badland sites in Almeria, Southern Spain. Geomorphology, 35, 87–99.

Feder, J. (1988) Fractals. Plenum Press, New York

Finnegan, N. J., Hallet, B., Montgomery, D. R., Zeitler, P. K., Stone, J. O., Anders, A. M., & Yuping, L. (2008). Coupling of rock uplift and river incision in the Namche Barwa–Gyala Peri massif, Tibet. Geological Society of America Bulletin, 120(1-2), 142-155.

Fraser, G. S., & DeCelles, P. G. (1992). Geomorphic controls on sediment accumulation at marginsof foreland basins. Basin Research, 4(3-4), 233-252.

Gajbhiye, S., Mishra, S. K., & Pandey, A. (2014). Prioritizing erosion-prone area through morphometric analysis: an RS and GIS perspective. Applied Water Science, 4(1), 51-61.

Gallart, F. (1992). In: Estudi Geomorphològic de la Conca d'Òdena. Estrat, vol. 3. Secció d'Arqueologia del Centre d'Estudis Comarcals d'Igualada, Igualada.

Gallart, F., Solé, A., Puigdefábregas, J., & Lázaro, R. (2002). Badland systems in the Mediterranean. Dryland Rivers: hydrology and geomorphology of semi-arid channels, 299-326.

Gaspar, L., Lizaga, I., & Navas, A. (2020). Elemental mobilisation by sheet erosion affected by soil organic carbon and water fluxes along a radiotraced soil catena with two contrasting parent materials. Geomorphology, 370, 107387.

Gaston, K. J., 2000. Global patterns in biodiversity. Nature, 405(6783), 220-227.

Gefen, Y., Aharony, A., Mandelbrot, B. B., 1984. Phase transitions on fractals. III. Infinitely ramified lattices. Journal of Physics A: Mathematical and General, 17(6), 1277.

Ghosh, R., Srivastava, P., Shukla, U.K., Singh. I., Champati Ray, P.K., & Sehgal R.K. (2018). Tectonic forcing of evolution and Holocene erosion rate of ravines in the Marginal Ganga Plain, India. J. Asian Earth Sci.,162: 137-147.

Grassberger, P. (1983). On efficient box counting algorithms. Int. J. Mod. Phys., C 4, 515–523.

Gregory, K. J. (1966). Dry valleys and the composition of the drainage net. Journal of Hydrology, 4, 327-340.

Gregory, K. J., & Walling, D. E. (1968). The variation of drainage density within a catchment. Hydrological Sciences Journal, 13(2), 61-68.

Gregory, K. J., & Walling, D. E. (1973). Drainage basin form and process.

Grove, A.T., & Rackham, O. (2001). Badlands. In: Grove, A.T., Rackham, O. (Eds.), The Natureof Mediterranean Europe: An Ecological History. Yale University Press, New Haven, pp. 271– 287.

Gupta, S., Jain, K. C., Srivastava, V. C., & Mehrotra, R. D. (2003). Depositional environment andtectonism during the sedimentation of the Semri and Kaimur Groups of rocks, Vindhyan Basin. JPalaeontol Soc India, 48, 181-90.

Gutierrez, M., Sancho, C., Benito, G., & Desir, G. (1997). Quantitative study of piping processesin badland areas of the Ebro basin, NE Spain. Geomorphology, 20, 237–253.

Guzman, C. D., Tilahun, S. A., Dagnew, D. C., Zegeye, A. D., Yitaferu, B., Kay, R. W., Steenhuis,
T. S., 2018. Developing soil conservation strategies with technical and community knowledge in a degrading sub-humid mountainous landscape. Land Degradation & Development, 29(3), 749- 764.

Hack, J. T. (1973). Stream-profile analysis and stream-gradient index. Journal of Research of theus Geological Survey, 1(4), 421-429.

Hadley, R., & Schumm, S. (1961) Sediment Sources and Drainage Basin Characteristics in UpperCheyenne River Basin. US Geol Surv Water-Supply Paper 1531-B, Washington DC: 198.

Hanway, J.J., & Heidel, H. (1952). Soil analysis methods as used in the Iowa State College Soil Testing Laboratory. Iowa Agric. 57:1-31

Hao, H., Cheng, L., Guo, Z., Wang, L., & Shi, Z. (2020). Plant community characteristics and functional traits as drivers of soil erodibility mitigation along a land degradation gradient. Land Degradation & Development, 31(14), 1851-1863.

Hare, P. W., & Gardner, T. W. (1985). Geomorphic indicators of vertical neotectonism along converging plate margins, Nicoya Peninsula, Costa Rica. Tectonic geomorphology, 4, 75-104.

Harvey, A. (1982). The role of piping in the development of badlands and gully systems in south-east Spain. In: Bryan, R., Yair, A. (Eds.), Badlands Geomorphology and Piping. Geo-Books (GeoAbstracts Ltd..), Norwich, England, pp. 317–335.

Harvey, A. M. (1987). Patterns of Quaternary aggradational and dissectional landform development in the Almeria region, southaest Spain: a dry-region, tectonically active landscape. Erde, 118(3), 193-215.

Harvey, A. M. (1992). Process interactions, temporal scales and the development of hillslope gullysystems: Howgill Fells, northwest England. Geomorphology, 5(3-5), 323-344.

Harvey, A., (2004). Badland. In: Goudie, A.S. (Ed.), Encyclopedia of Geomorphology. Routledge,pp. 45–48.

Harvey, A.M., Whitfield, E., Stokes, M., Mather, A., (2014). The late Neogene to Quaternary drainage evolution of the uplifted Neogene sedimentary basins of Almeria, Betic Chain. In: Gutiérrez, F., Gutiérrez, M. (Eds.), Landscapes and Landforms of Spain, World GeomorphologicalLandscapes. Springer, Dordrecht, pp. 37–61.

Hooke, R.LeB., Martín-Duque, J.F., & Pedraza, J. (2012). Land transformation by humans: a review. Geological Society of America Today, 22, 4–10.

Horton, R. E. (1932). Drainage-basin characteristics. Eos, transactions american geophysical union, 13(1), 350-361.

Horton, R.E. (1945). Erosional development of streams and their drainage basins; hydrophysical approach to quantitative morphology. Geol Soc Am Bull, 56:275–370

Howard, A. D. (2009). Badlands and gullying. In Geomorphology of desert environments (pp. 265-299). Springer, Dordrecht.

Howard, A.D. (1994). Badlands. In: Abrahams, A., Parsons, A. (Eds.), Geomorphology of DesertEnvironments. Chapman & Hall, London, pp. 213–242.

Imeson, A., Kwaad, F.J.P.M., & Verstraten, J.M. (1982). The relationship of soil physical and chemical properties to the development of badlands in Morocco. In: Bryan, R., Yair, A. (Eds.), Badland Geomorphology and Piping. Geo Books, Norwich, pp. 47–69.

Imeson, A.C., 1983. Studies of erosion thresholds in semi-arid areas: field measurements of soil loss and infiltration in northern Morocco. Catena (Suppl. 4), 79–89.

Jasmin, I., & Mallikarjuna, P. (2013). Morphometric analysis of Araniar river basin using remote sensing and geographical information system in the assessment of groundwater potential. ArabianJournal of Geosciences, 6(10), 3683-3692.

Jenny, H. (1941). Factors of soil formation: a system of quantitative pedology. Dover Publications,New York, p 191

Jha, M., Tignath, S., & Rathore, B. S. (2013). Rehabilitation watershed development for relocationof people. J Ind Geol Cong, 5(2), 51-59.

Jha, M., Tignath, S., & Singh, B. N. (2009). Drainage Characterization of Pariyat Watershed, Jabalpur, India. Hydrol J, 32(3-4), 157-169.

Jianjun, H., & Mukang, H. (1994). Activities Of The Buried Tectonic Structures In Holocene In The Weihe Basin, Northwest China, As Revealed By Drainage Density Analysis [J]. Acta Geographica Sinica, 3.

Johnston, K., Ver Hoef, J. M., Krivoruchko, K., & Lucas, N. (2001). Using ArcGIS geostatisticalanalyst (Vol. 380). Redlands: Esri.

Joshi, V. U., & Nagare, V. B. (2013). Badland formation along the Pravara River, Western Deccan,India. Can neotectonics be the cause?. Zeitschrift für Geomorphologie, 57(3), 349-370.

Joshua, J.R., Benjamin, H.M., Alexander, L.H., Adam, M.B., David, A.S., Georgina, L.B., & Corina, C.D. (2015). Beyond the angle of repose: A review and synthesis of landslide processes inresponse to rapid uplift, Eel River, Northern California. Geomorphology, 236

Kale, V. S., & Shejwalkar, N. (2008). Uplift along the western margin of the Deccan Basalt Province: Is there any geomorphometric evidence?. Journal of Earth System Science, 117(6), 959-971.

Kandregula, R. S., Kothyari, G. C., Swamy, K. V., & Rawat, S. (2019). Quantitative assessment of tectonic activity in Northern Saurashtra, Western India. J. Indian Geophys. Union, 23(6), 542-558.

Karperien, A., 2007-2012. Fraclac for imagej version, 2.

Kasanin-Grubin, M. (2013). Clay mineralogy as a crucial factor in badlands hillslope processes. Catena, 106, 54–67.

Kaul, O. N. (1962). Management of Chambal ravines in Rajasthan. Indian Forester, 88(10), 725-730.

Keller, E. A., & Pinter, N. (1996). Active tectonics: Earthquakes, Uplift and Landscapes. PrenticeHall, New Jersey, 338p.

Keller, E.A., & Pinter, N. (Eds.), (2002). Active Tectonics: Earthquakes, Uplift, and Landscape,2nd ed. Prentice Hall, Upper Saddle River, N.J. 362.

Khorasani, H., Zheng, Z., Nguyen, C., Zara, J., Zhang, X., Wang, J., Ting, K., Soo, C.A.,

Kirkby Haigh, M. J. (1984). Ravine erosion and reclamation in India. Geoforum, 15(4), 543-561.

Komuscu, U. A. (1999). Using the SPI to analyze spatial and temporal patterns of drought in Turkey. Drought Network News (1994-2001), 49.

Kong, L., Ostadhassan, M., Liu, B., Li, C., Liu, K., 2019. Multifractal characteristics of MIP-basedpore size distribution of 3D-printed powder-based rocks: a study of post-processing effect. Transport in Porous Media, 129(2), 599-618.

Koons, P. O. (1989). The topographic evolution of collisional mountain belts; a numerical look atthe Southern Alps, New Zealand. American journal of Science, 289(9), 1041-1069.

Kothyari, G. C. (2014). Morphometric analysis of tectonically active Pindar and Saryu River basins: central Kumaun Himalaya. Zeitschrift für Geomorphologie, 59(4), 421-442.

Kumar, A., Gopalan, K., & Rajagopalan, G. (2001). Age of the Lower Vindhyan sediments, centralIndia. Current Science-Bangalore, 81(7), 806-808.

Kumar, R., Bhardwaj, A. K., Rao, B. K., Vishwakarma, A. K., Bhatnagar, P. R., Patra, S., Kumar,G., Kakade, V., Dinesh, D., Pande, VC., Singh, G., Dobhal, S., & Sharma, N. K. (2021). Development of degraded ravine lands of Western India using Sapota (Achras zapota) plantation with terracing vs. trenching-on-slope-based conservation measures. Land Degradation & Development, 32(1), 101-111.

La Barbera, P. & Rosso, R. (1989). On the fractal dimension of stream networks. Water Resour Res 25(4):735–741

Lambert, D. (1998) Field Guide Geol. Checkmark Books.

Leopold, W. (1964). Miller. 1964. Fluvial processes in geomorphology.

Lerman, J. C. (1972). Soil-Co 2 and groundwater: carbon isotope compositions. In Proceedings ofthe 8th International Conference on Radiocarbon Dating.

Levy, G. J., Eisenberg, H., & Shainberg, I. (1993). Clay dispersion as related to soil properties andwater permeability. Soil Science, 155(1), 15-22.

Li, S., Verburg, P. H., Lv, S., Wu, J., & Li, X. (2012). Spatial analysis of the driving factors of grassland degradation under conditions of climate change and intensive use in Inner Mongolia, China. Regional Environmental Change, 12(3), 461-474.

Lichtfouse, E., Navarrete, M., Debaeke, P., Véronique, S., & Alberola, C. (Eds.). (2009). Sustainable agriculture (p. 97). Springer Netherlands.

Lillesand, T. M., Kiefer, R. W. & X Chipman, R. W. (2004). Remote Sensing and Image Interpretation, John Wiley & Sons, Inc., 5,

Liu, G., Zheng, F., Wilson, G. V., Xu, X., Liu, C., 2021. Three decades of ephemeral gully erosionstudies. Soil and Tillage Research, 212, 105046.

Liu, Y., Zha, Y., Gao, J., & Ni, S. (2004). Assessment of grassland degradation near Lake Qinghai,West China, using Landsat TM and in situ reflectance spectra data. International Journal of Remote Sensing, 25(20), 4177-4189.

Lopez-Bermudez, F., & Romero-Diaz, M. (1989). Piping erosion and badland development in southeast Spain. Catena, 59-73.

Lovejoy, S., & Schertzer, D. (1986). Scale invariance, symmetries, fractals, and stochastic simulations of atmospheric phenomena. Bulletin of the American meteorological society, 67(1), 21-32.

Luo, J., Zheng, Z., Li, T., He, S., 2018. Assessing the impacts of microtopography on soil erosion under simulated rainfall, using a multifractal approach. Hydrological Processes, 32(16), 2543- 2556.

Lusby, G. C. (1970). Hydrologic and biotic effects of grazing vs. non-grazing near Grand Junction, Colorado. Rangeland Ecology & Management/Journal of Range Management Archives, 23(4), 256-260.

Maas, E. V., & Ogata, G. (1972). Radial transport of sodium and chloride into tomato rootxylem. Plant physiology, 50(1), 64-68.

Magesh, N. S., Jitheshlal, K. V., Chandrasekar, N., & Jini, K. V. (2013). Geographical information system-based morphometric analysis of Bharathapuzha river basin, Kerala, India. Applied Water Science, 3(2), 467-477.

Magesh, N.S., Chandrasekar, N. & Soundranayagam, J.P. (2011). Morphometric Evaluation of Papanasam and Manimuthar Watersheds, Part of Western Ghats, Tirunelueli District, Tamil Nadu, India: A GIS Approach. Environmental Earth Sciences, 64, 373-381.

Maheshwari, B. L., & Jayawardane, N. S. (1992). Infiltration characteristics of some clayey soilsmeasured during border irrigation. Agricultural Water Management, 21(4), 265-279.

Makarieva, A. M., Gorshkov, V. G., Li, B. L., 2005. Revising the distributive networks models of West, Brown and Enquist (1997) and Banavar, Maritan and Rinaldo (1999): Metabolic inequity ofliving tissues provides clues for the observed allometric scaling rules. Journal of Theoretical Biology, 237(3), 291-301.

Malinverno, A. (1989). Testing linear models of sea floor topography. Pure and Applied Geophysics, 131, 139-55.

Mandelbrot, B. (1967). How long is the coast of Britain? Statistical self-similarity and fractional dimension. science, 156(3775), 636-638.

Mandelbrot, B. B., 1974. Intermittent turbulence in self-similar cascades: divergence of high moments and dimension of the carrier. Journal of fluid Mechanics, 62(2), 331-358.

Mandelbrot, B. B., 1975. Les objets fractals: forme, hasard et dimension (Vol. 17). Paris: Flammarion.

Mandelbrot, B. B., 1983. The fractal geometry of Nature WH Freeman and Company. New York,468.

Mandelbrot, B.B., 1982. The Fractal geometry of nature. W. H. Freeman, New York

Martínez-Murillo, J. F., & Nadal-Romero, E. (2018). Perspectives on Badland Studies in the Context of Global Change. In Badlands Dynamics in a Context of Global Change (pp. 1-25). Elsevier.

Marzolff, I., Poesen, J., & Ries, J. B. (2011). Short to medium-term gully development: human activity and gully erosion variability in selected Spanish gully catchments. Landform Analysis, 17,111-116.

Mather, A. E., Stokes, M., & Griffiths, J. S. (2002). Quaternary landscape evolution: a frameworkfor understanding contemporary erosion, southeast Spain. Land Degradation &Development, 13(2), 89-109.

McCloskey, G. L., Wasson, R. J., Boggs, G. S., & Douglas, M. (2016). Timing and causes of gully erosion in the riparian zone of the semi-arid tropical Victoria River, Australia: Management implications. Geomorphology, 266, 96-104.

McKee, T. B. (1995). Drought monitoring with multiple time scales. In Proceedings of 9th Conference on Applied Climatology, Boston, 1995.

McKee, T. B., Doesken, N. J., & Kleist, J. (1993). The relationship of drought frequency and duration to time scales. In Proceedings of the 8th Conference on Applied Climatology (Vol. 17, No. 22, pp. 179-183).

Meliho, M., Khattabi, A., & Mhammdi, N. (2020). Spatial assessment of soil erosion risk by integrating remote sensing and GIS techniques: a case of Tensift watershed in Morocco. Environmental Earth Sciences, 79(10), 1-19.

Michael, A. M., & Ojha, T. P. (1966). Principles of Agricultural Engineering: Agricultural surveying, irrigation, agricultural drainage, soil and water conservation (Vol. 2). Jain Brothers.

Miller, V. C. (1953). A Quantitative Geomorphic Study Of Drainage Basin Characteristics

In TheClinch Mountain Area Virginia And Tennessee. Columbia Univ New York.

Milne, M.T., 1991. Lessons from applying fractal models to landscape patterns. In: Turner, M.G.,Gardner, R.H. (Eds.), Quantitative Methods in Landscape Ecology. Springer-Verlag, New York, USA, pp. 199–235.

Mishra, S. K., Tyagi, J. V., & Singh, V. P. (2003). Comparison of infiltration models. Hydrologicalprocesses, 17(13), 2629-2652.

Mishra, S., Tiwary, D., Ohri, A., & Agnihotri, A. K. (2018). Assessment of groundwater quality using WQI and GIS near the Karsara municipal landfill site, Varanasi, India. Arabian Journal of Geosciences, 11(11), 1-9.

Misra, A., Agarwal, K. K., Kothyari, G. C., Talukdar, R., & Joshi, G. (2020). Quantitative geomorphic approach for identifying active deformation in the foreland region of central Indo- Nepal Himalaya. Geotectonics, 54(4), 543-562.

Molnar, P., & England, P. (1990). Late Cenozoic uplift of mountain ranges and global climate change: chicken or egg?. Nature, 346(6279), 29-34.

Mondal, P. (2013). Morphometric analysis of Birbhum district. Asian Journal of MultidisciplinaryStudies, 1(4), 141-148.

Montero, E., 2005. Rényi dimensions analysis of soil particle-size distributions. Ecological Modelling, 182(3-4), 305-315.

Moreno-de las Heras, M., & Gallart, F. (2016). Lithology controls the regional distribution and morphological diversity of montane Mediterranean badlands in the upper Llobregat basin (easternPyrenees). Geomorphology, 273, 107-115.

Moreno-de las Heras, M., & Gallart, F. (2018). The origin of badlands. In Badlands Dynamics ina Context of Global Change (pp. 27-59). Elsevier.

Moreno-de-las-Heras, M., Lindenberger, F., Latron, J., Lana-Renault, N., Llorens, P., Arnáez, J., & Gallart, F. (2019). Hydro-geomorphological consequences of the abandonment of agricultural terraces in the Mediterranean region: Key controlling factors and landscape stability patterns. Geomorphology, 333, 73-91.

Morgan, R.P.C. (1986). Soil Erosion and Conservation. Longman, Harlow, p. 298.

Morisawa, M. (1958). Measurement of drainage-basin outline form. The Journal of Geology, 66(5), 587-591.

Morisawa, M. E. (1959). Relation on morphometric properties to runoff in the Little Mill Creek. Ohio, drainage basin. Tech. Rep. 17, Columbia University, Department of Geology, ONR, New York.

Nadal-Romero, E., & Regüés, D. (2010). Geomorphological dynamics of subhumid mountain badland areas—weathering, hydrological and suspended sediment transport processes: a case study in the Araguás catchment (Central Pyrenees) and implications for altered hydroclimatic regimes. Progress in Physical Geography, 34(2), 123-150.

Nag, S. K. (1998). Morphometric analysis using remote sensing techniques in the Chaka sub-basin,Purulia district, West Bengal. Journal of the Indian society of remote sensing, 26(1), 69-76.

Nag, S. K., & Chakraborty, S. (2003). Influence of rock types and structures in the development of drainage network in hard rock area. Journal of the Indian Society of Remote Sensing, 31(1), 25-35.

Narendra, K., & Rao, K. N. (2006). Morphometry of the Meghadrigedda watershed, Visakhapatnam district, Andhra Pradesh using GIS and Resourcesat data. Journal of the Indian Society of Remote Sensing, 34(2), 101-110.

National Bureau of Soil Survey and Land Use Planning (NBSS&LUP) (2012). Global Assessmentof Soil Degradation (GLASOD) Guidelines; NBSS&LUP: Nagpur, India

Neina, D. (2019). The role of soil pH in plant nutrition and soil remediation. Applied and Environmental Soil Science, 2019.

Obruchev, V. A. (1948). Main features of kinetics and plastics of neotectonics. Izv. AN SSSR. Ser.Geol., 5, 13-24.

Olsson, J., Niemczynowicz, J., & Berndtsson, R. (1993). Fractal analysis of high-resolution rainfalltime series. Journal of Geophysical Research: Atmospheres, 98(D12), 23265-23274.

Olsson, J., Niemczynowicz, J., Berndtsson, R., & Larson, M. (1992). An analysis of the rainfall time structure by box counting—some practical implications. Journal of Hydrology, 137(1-4), 261-277.

Ostovari, Y., Moosavi, A. A., & Pourghasemi, H. R. (2020). Soil loss tolerance in calcareous soils of a semiarid region: evaluation, prediction, and influential parameters. Land Degradation & Development, 31(15), 2156-2167.

Ouchi, S. (1985). Response of alluvial rivers to slow active tectonic movement. Geological Societyof America Bulletin, 96(4), 504-515.

Ozdemir, H., & Bird, D. (2009). Evaluation of morphometric parameters of drainage networks derived from topographic maps and DEM in point of floods. Environmental geology, 56(7), 1405-1415.

Pagliai, M., Marsili, A., Servadio, P., Vignozzi, N., & Pellegrini, S. (2003). Changes in some physical properties of a clay soil in Central Italy following the passage of rubber tracked and wheeled tractors of medium power. Soil and Tillage Research, 73(1-2), 119-129.

Pagliai, M., Vignozzi, N., & Pellegrini, S. (2004). Soil structure and the effect of management practices. Soil and Tillage Research, 79(2), 131-143.

Pancholi, V., Kothyari, G. C., Prizomwala, S., Sukumaran, P., Shah, R. D., Chauhan, N. B. M., & Kandregula, R. S. (2017). Morphotectonic of Sabarmati-Cambay basin, Gujarat, Western India. JInd Geophys Union, 21, 371-383.

Pandey, A., Bishal, K. C., Kalura, P., Chowdary, V. M., Jha, C. S., & Cerdà, A. (2021). A Soil Water Assessment Tool (SWAT) Modeling Approach to Prioritize Soil Conservation Managementin River Basin Critical Areas Coupled With Future Climate Scenario Analysis. Air, Soil and WaterResearch, 14, 11786221211021395.

Pandey, A., Chowdary, V. M., & Mal, B. C. (2004). Morphological analysis and watershed management using GIS. Hydrol J (India), 27(3-4), 71-84.

Pandey, G., Lovejoy, S., Schertzer, D., 1998. Multifractal analysis of daily river flows including extremes for basins of five to two million square kilometres, one day to 75 years. Journal of Hydrology, 208(1-2), 62-81.

Pani P. (2012) Through Maps, A. J. Understanding Land Degradation Scenario in Chambal, IndiaIndian Cartographer, Vol. XXXII.

Parasiewicz, P., Castelli, E., Rogers, J. N., Vezza, P., & Kaupsta, A. (2017). Implementation of the natural flow paradigm to protect dwarf wedgemussel (Alasmidonta heterodon) in the upper Delaware River. River Research and Applications, 33(2), 277-291.

Pardini, G., Guidi, G. V., Pini, R., Regüés, D., & Gallart, F. (1996). Structure and porosity of smectitic mudrocks as affected by experimental wetting—drying cycles and freezing—thawing cycles. Catena, 27(3-4), 149-165.

Parkash, B. & Kumar, S. (1991). The Indo-Gangetic basin. In: Tandon, S.K., Pant, C.C. & Casshyap, S.M.(eds.) Sedimentary Basins of India. Proceedings of the Seminar held at Department of Geology, Kumaun University, Nainital, Gyanodaya Prakashan, Nainital, India, 147-170.

Parker, D. B., Michel, T. G., & Smith, J. L. (1995). Compaction and water velocity effects on soilerosion in shallow flow. Journal of Irrigation and Drainage Engineering, 121(2), 170-178.

Parmar, M., Bhawsar, Z., Kotecha, M., Shukla, A., & Rajawat, A. S. (2021). Assessment of LandDegradation Vulnerability using Geospatial Technique: A Case Study of Kachchh District of Gujarat, India. Journal of the Indian Society of Remote Sensing, 1-15.

Pearson, K. (1920). Notes on the history of correlation. Biometrika, 13(1), 25-45.

Penck, W. (1953). Morphological analysis of land forms. AUS Geomorphology.

Perry, E. B. (1975). Piping in earth dams constructed of dispersive clay: Literature review and design of laboratory tests.

Phillips, C. P., & Robinson, D. A. (1998). The impact of land use on the credibility of dispersive clay soils in central and southern Italy. Soil use and management, 14(3), 155-161.

Piccarreta, M., Faulkner, H., Bentivenga, M., & Capolongo, D. (2006). The influence of physico-chemical material properties on erosion processes in the badlands of Basilicata, Southern Italy. Geomorphology, 81(3-4), 235-251.

Pike, A. S., Scatena, F. N., & Wohl, E. E. (2010). Lithological and fluvial controls on the geomorphology of tropical montane stream channels in Puerto Rico. Earth Surface Processes andLandforms, 35(12), 1402-1417.

Pinna, S. E. R. G. I. O., & Vittorini, S. E. B. A. S. T. I. A. N. O. (1989). Su alcune caratteristichedelle argille plioceniche della Valle dell'Era (Toscana) in rapporto alla genesi di calanchi e biancane. Geografia Fisica e Dinamica Quaternaria, 12, 131-137.

Pinter, N., & Keller, E. A. (2002). Active Tectonics: Earthquakes, Uplift, and Landscape.Plotnick, R. E., Gardner, R. H., Hargrove, W. W., Prestegaard, K., Perlmutter, M., 1996. Lacunarity analysis: a general technique for the analysis of spatial patterns. Physical reviewE, 53(5), 5461.

Poesen JWA, Hooke JM. 1997. Erosion, flooding and channel management in Mediterranean environments of southern Europe. Progress in Physical Geography 21(2): 157–199.

Posadas, A. N., Giménez, D., Bittelli, M., Vaz, C. M., Flury, M., 2001. Multifractal characterization of soil particle-size distributions. Soil Science Society of America Journal, 65(5),1361-1367.

Prakash, K., Mohanty, T., Pati, J. K., Singh, S., & Chaubey, K. (2017). Morphotectonics of the Jamini River basin, Bundelkhand Craton, Central India; using remote sensing and GIS technique. Applied Water Science, 7(7), 3767-3782.

Preston, N. J., & Crozier, M. J. (1999). Resistance to shallow landslide failure through root-derivedcohesion in east coast hill country soils, North Island, New Zealand. Earth Surface Processes andLandforms: The Journal of the British Geomorphological Research Group, 24(8), 665-675.

Prosser, I. P., & Soufi, M. (1998). Controls on gully formation following forest clearing in a humidtemperate environment. Water Resources Research, 34(12), 3661-3671.

Puigdefábregas, J. (2005). The role of vegetation patterns in structuring runoff and sediment fluxesin drylands. Earth Surface Processes and Landforms: The Journal of the British Geomorphological Research Group, 30(2), 133-147.

Quirk, J.P., & Schofield, R.K., (1955). The effect of electrolyte concentration on soil permeability.

Journal of Soil Science 6, 163–178.

Raiesi, F., & Salek-Gilani, S. (2020). Development of a soil quality index for characterizing effectsof land-use changes on degradation and ecological restoration of rangeland soils in a semi-arid ecosystem. Land Degradation & Development, 31(12), 1533-1544.

Raju, G. S., & Babu, K. R. (2012). Morphometric analysis of Kunderu river basin, Kurnool district, AP, India for watershed management. Journal of environmental science & engineering, 54(1), 85-89.

Ram, J., Shukla, S. N., Pramanik, A. G., Varma, B. K., Chandra, G., & Murthy, M. S. N. (1996). Recent investigations in the Vindhyan basin: implications for the basin tectonics. Memoirs-Geological Society of India, 267-286.

Ramakrishnan, M., & Vaidyanadhan, R. (2010). Geology of India (vol. 1 & 2). GSI Publications, 2(1).

Ranga, V., Mohapatra, S. N., & Pani, P. (2015). Geomorphological evolution of badlands based on the dynamics of palaeo-channels and their implications. Journal of Earth System Science, 124(5), 909-920.

Rao, M. R. (1973). The subsurface geology of the Indo-Gangetic plains. Journal of Geological Society of India (Online archive from Vol 1 to Vol 78), 14(3), 217-242.

Rawat, P. K., Tiwari, P. C., Pant, C. C., Sharama, A. K., & Pant, P. D. (2011). Morphometric analysis of third order river basins using high resolution satellite imagery and GIS technology: special reference to natural hazard vulnerability assessment. E-Int Sci Res J, 3(2), 70-87.

Ray, J. S. (2006). Age of the Vindhyan Supergroup: a review of recent findings. Journal of EarthSystem Science, 115(1), 149-160.

Real, L. S. C., Crestana, S., Ferreira, R. R. M., Sígolo, J. B., Rodrigues, V. G. S., 2020. Proposition for a new classification of gully erosion using multifractal and lacunarity analysis: A complex of gullies in the Palmital stream watershed, Minas Gerais (Brazil). Catena, 186, 104377.

Regüés, D., Pardini, G., & Gallart, F. (1995). Regolith behaviour and physical weathering of clayey mudrock as dependent on seasonal weather conditions in a badland area at Vallcebre, Eastern Pyrenees. Catena, 25(1-4), 199-212.

Rengasamy, P., Greene, R. S. B., Ford, G. W., & Mehanni, A. H. (1984). Identification of dispersive behaviour and the management of red-brown earths. Soil Research, 22(4), 413-431.

Rice, R. M., & Foggin III, G. T. (1971). Effect high intensity storms on soil slippage on mountainous watersheds in Southern California. Water Resources Research, 7(6), 1485-1496.

Richardson, L. F. (1961). The problem of contiguity: an appendix of statistics of deadly quarrels. General system yearbook, 6, 139-187.

Ritter, M. E. (2012). Barriers to Teaching Introductory Physical Geography On-line. Review of International Geographical Education Online, 2(1).

Robinson, D. A., & Phillips, C. P. (2001). Crust development in relation to vegetation and agricultural practice on erosion susceptible, dispersive clay soils from central and southernItaly. Soil and Tillage Research, 60(1-2), 1-9.

Robinson, T. P., & Metternicht, G. (2006). Testing the performance of spatial interpolation techniques for mapping soil properties. Computers and electronics in agriculture, 50(2), 97-108.

Rodríguez-Lado, L., Lado, M., 2017. Relation between soil forming factors and scaling propertiesof particle size distributions derived from multifractal analysis in topsoils from Galicia (NW Spain). Geoderma, 287, 147-156.

Romero, C. C., Stroosnijder, L., & Baigorria, G. A. (2007). Interrill and rill erodibility in the northern Andean Highlands. Catena, 70(2), 105-113.

Romero-Díaz, A., Ruíz-Sinoga, J. D., & Belmonte-Serrato, F. (2020). Physical-chemical and mineralogical properties of parent materials and their relationship with the morphology of badlands. Geomorphology, 354, 107047.

Rosso, R., Bacchi, B., & La Barbera, P. (1991). Fractal relation of mainstream length to catchmentarea in river networks. Water Resources Research, 27(3), 381-387.

Safaya, H. L. (1975). Microfacies and Depositional History of Strand-Line Carbonates of the Semri Series, Lower Vindhyan System, Banda District, Uttar Pradesh. Journal of Geological Society of India (Online archive from Vol 1 to Vol 78), 16(3), 294-303.

Sahoo, R., & Jain, V. (2017). Process interpretation using Fractal dimension: a case study from NW Himalaya.

Salomons, W., Goudie, A., & Mook, W. G. (1978). Isotopic composition of calcrete deposits fromEurope, Africa and India. Earth Surface Processes, 3(1), 43-57.

Scheidegger, A. E. (1965). The algebra of stream-order numbers. Washington, DC: US GeologicalSurvey, Professional Paper B, 525.

Schertzer, D., & Lovejoy, S. (1991). Nonlinear variability in geophysics. Scaling and Multifractalprocesses.

Schmidt, J. (1996). Entwicklung und Anwendung eines physikalisch begründeten Simulationsmodells für die Erosion geneigter landwirtschaftlicher Nutzflächen. Selbstverl. des Inst. für Geograph. Wiss., Berlin.

Schoonover, W. R. (1952). Examination of soils for alkali. Berkeley: University of California. Extension Service.

Schumm, S. A. (1956). Evolution of drainage systems and slopes in badlands at Perth Amboy, New Jersey. Geological society of America bulletin, 67(5), 597-646.

Sdao, G. I. U. S. E. P. P. E., Simone, A. N. T. O. N. I. O., & Vittorini, S. E. B. A. S. T. I. A. N. O.
(1984). Osservazioni geomorfologiche su calanchi e biancane in Calabria. Geografia Fisica e Dinamica Quaternaria, 7, 10-16.

Sedgwick, P. (2012). Pearson's correlation coefficient. Bmj, 345.

Selhorst, A., & Lal, R. (2012). Effects of climate and soil properties on US home lawn soil organiccarbon concentration and pool. Environmental management, 50(6), 1177-1192.

Shainberg, I., Alperovitch, N., & Keren, R. (1988). Effect of magnesium on the hydraulicconductivity of Na-smectite-sand mixtures. Clays Clay Miner, 36(5), 432-438.

Sharma, H. S. (1980). Ravine erosion in India. Concept Publishing Company.

Sharma, H.S., & Pani, P. (2017). Geomorphological field guide book on Chambal badlands. 9th International conference on geomorphology, NewDelhi, India.

Sharmeen, S., & Willgoose, G. R. (2006). The interaction between armouring and particleweathering for eroding landscapes. Earth Surface Processes and Landforms: The Journal of the British Geomorphological Research Group, 31(10), 1195-1210.

Shreve, R. L. (1967). Infinite topologically random channel networks. The Journal of Geology, 75(2), 178-186.

Sidle, R. C., Jarihani, B., Kaka, S. I., Koci, J., Al-Shaibani, A., 2019. Hydrogeomorphic processesaffecting dryland gully erosion: Implications for modelling. Progress in Physical Geography: Earthand Environment, 43(1), 46-64.

Simon, A., & Collison, A. J. (2002). Quantifying the mechanical and hydrologic effects of riparianvegetation on streambank stability. Earth surface processes and landforms, 27(5), 527-546.

Singh, I. B. (1996). Geological evolution of Ganga Plain—an overview. Journal of the Palaeontological Society of India, 41, 99-137.

Singh, I. B., & Bajpai, V. N. (1989). Significance of syndepositional tectonics in facies development, Gangetic, Alluvium near Kanpur, Uttar Pradesh. Journal of Geological Society of India (Online archive from Vol 1 to Vol 78), 34(1), 61-66.

Singh, S. N., & Pal, O. P. (1970). Geology around Chitrakut area, district Banda, UP: Jour. Palaeontol. Soc. India, 14, 77.

Singh, S., & Dubey, A. (1994). Geoenvironmental planning of watersheds in India. Chugh.

Sinha, R., Khanna, M., Jain, V., & Tandon, S. K. (2002). Mega-geomorphology and sedimentationhistory of parts of the Ganga-Yamuna plains. Current Science, 82(5), 526-566.

Smith, K. G. (1950). Standards for grading texture of erosional topography. American journal of Science, 248(9), 655-668.

Snow, R. S. (1989). Fractal sinuosity of stream channels. Pure and applied geophysics, 131(1), 99-109.

Soil Survey Staff (1951). Soil Survey Manual. United States Department of Agriculture. HandbookNo. 18.

Sole, A., Gallart, F., Pardini, G., & Aringhieri, R. (1992). How mudrock and soil physical properties influence badland formation at Vallcebre (Pre-Pyrenees, NE Spain). Catena, 19(3-4), 287-300.

Soleī-Benet, A., Calvo, A., Cerda, A., Laīzaro, R., Pini, R., & Barbero, J. (1997). Influences of micro-relief patterns and plant cover on runoff related processes in badlands from Tabernas (SE Spain). Catena, 31(1-2), 23-38.

Song, S., Zeng, L., Wang, Y., Li, G., Deng, X., 2019. The response of river network structure to urbanization: A multifractal perspective. Journal of cleaner production, 221, 377-388.

Sreedevi, P. D., Subrahmanyam, K., & Ahmed, S. (2005). The significance of morphometric analysis for obtaining groundwater potential zones in a structurally controlled terrain. Environmental Geology, 47(3), 412-420.

Srivastava, R. P., Vedanti, N., Pandey, O. P., & Dimri, V. P. (2009). Detailed gravity studies overJabera—Damoh region of the Vindhyan basin (Central India) and crustal evolution. Journal of theGeological Society of India, 73(5), 715-723.

Srtvastava, V. K., & Mitra, D. (1995). Study of drainage pattern of Raniganj Coalfield (BurdwanDistrict) as observed on Landsat-TM/IRS LISS II imagery. Journal of the Indian Society of RemoteSensing, 23(4), 225-235.

Stern, R., Ben-Hur, M., & Shainberg, I. (1991). Clay mineralogy effect on rain infiltration, seal formation and soil losses. Soil Science, 152(6), 455-462.

Strahler, A. N. (1952). Hypsometric (area-altitude) analysis of erosional topography. Geological society of America bulletin, 63(11), 1117-1142.

Strahler, A. N. (1957). Quantitative analysis of watershed geomorphology. Eos, Transactions American Geophysical Union, 38(6), 913-920.

Strahler, A. N. (1964). Quantitative geomorphology of drainage basin and channel networks. Handbook of applied hydrology.

Subbiah, B.V., & Asija, G.L. (1956). A rapid procedure for the determination of available nitrogenin soil. Curr. Sci. 25: 259-60.

Summa, V., & Giannossi, M. L. (2013). The Role of Soil Mineralogy, Geochemistry and Grain Size in the Development of Mediterranean Badlands: A. Soil Processes and Current Trends in Quality Assessment, 1.

Svensson, C., Olsson, J., & Berndtsson, R. (1996). Multifractal properties of daily rainfall in two different climates. Water Resources Research, 32(8), 2463-2472.

Szczepaniak, A., Macek, W. M., 2008. Asymmetric multifractal model for solar wind intermittentturbulence. Nonlinear Processes in Geophysics, 15(4), 615-620.

Taloor, A. K., Joshi, L. M., Kotlia, B. S., Alam, A., Kothyari, G. C., Kandregula, R. S., ... & Dumka, R. K. (2021). Tectonic imprints of landscape evolution in the Bhilangana and Mandakinibasin, Garhwal Himalaya, India: a geospatial approach. Quaternary International, 575, 21-36.

Tarboton, D. G., Bras, R. L., & Rodriguez-Iturbe, I. (1988). The fractal nature of river networks. Water Resources Research, 24(8), 1317-1322.

Taylor, G., &Eggleton, R.A. (2001). Regolith Geology and Geomorphology. John Wiley & Sons,p. 375.

Tejwani, K. G. (1959). Soil and water conservation in the ravine lands of

Gujarat.Thornes, J. B. (1985). The ecology of erosion. Geography, 222-235.

Tignath, S., Chaube, U. C., Mishra, S. K., & Awasthi, A. K. (2005). System approach to socio- economic and ecological management of a small badland in Narmada Valley (India). In Proc. of International Conf. on Hydrological Perspectives for Sustainable Development-(HYPSED- 2005) (pp. 485-496).

Tignath, S., Kapoor, M., Jha, M., & Sharma, S. K. (2014). Morphometric analysis of part of the Hiran River, District Jabalpur, MP, India using Remote sensing and GIS. International Journal ofEnvironmental Sciences, 5(1), 181-196.

Tomislav, H. (2009). Practical guide to geostatistical mapping. EUR 22904 EN.

Tong, S., Zhiming, F., Yanzhao, Y., Yumei, L., & Yanjuan, W. (2018). Research on land resourcecarrying capacity: Progress and prospects. Journal of Resources and Ecology, 9(4), 331-340.

Torri, D., & Brya, R. (1997). Micropiping processes and biancana evolution in southeast Tuscany,Italy. Geomorphology, 20(3-4), 219-235.

Torri, D., Calzolari, C., & Rodolfi, G. (2000). Badlands in changing environments: an introduction. Catena, 40(2), 119-125.

Tukey, J. W. (1977). Exploratory data analysis. Addison-Wesley, Reading, MA. Exploratory dataanalysis. Addison-Wesley, Reading, MA.

Turcotte, D. L. (1992). Fractals and chaos in geology and geophysics, Cambridge University Press,221.

Ullah, Z., Ali, S., Muhammad, N., Khan, N., Rizwan, M., Khan, M. D., Khan, N., Khattak, B., Alhaithloul, H.A.S., Soliman, M.H., Ullah, H., Begum, D., & Ali, N. (2020). Biochar impact on microbial population and elemental composition of red soil. Arabian Journal of Geosciences, 13(16), 1-9.

USDA Technical Bulletin No.1355. US Government Printing Office, Washington, DC

USDA, SCS, Agriculture Handbook No. 61 (1954). A Manual on Conservation of Soil and Water,Handbook for Agricultural Workers. USDA, Washington, D.C. 208 p.

Valdiya, K.S. (1976). Himalayan transverse faults and folds and their parallelism with subsurfacestructures of north Indian plains. Tectonophysics, 32(3-4), 353-386.

Vanwalleghem, T., Bork, H. R., Poesen, J., Schmidtchen, G., Dotterweich, M., Nachtergaele, J.,
... & De Bie, M. (2005). Rapid development and infilling of a buried gully under cropland, centralBelgium. Catena, 63(2-3), 221-243.

Vergari, F., Della Seta, M., Del Monte, M., & Barbieri, M. (2013). Badlands denudation “hot spots”: the role of parent material properties on geomorphic processes in 20-years monitored sitesof Southern Tuscany (Italy). Catena, 106, 31-41.

Veselá, M., Zmenkal, O., Veselý, M., & Neqádal, M. (2002). The use of fractal analysis for the determination of yeast cell diameter. HarFA—Harmonic and Fractal Image Analysis, 21-22.

Vetter, S., & Bond, W. J. (2012). Changing predictors of spatial and temporal variability in stocking rates in a severely degraded communal rangeland. Land Degradation & Development, 23(2), 190-199.

Vicsek, T. (1992). Fractal growth phenomena. World scientific.

Vicsek, T., 1992. Dynamics of growing self-affine surfaces. In From Phase Transitions To Chaos:Topics in Modern Statistical Physics pp. 237-248.

Vittorini, S. (1977). Osservazioni sull'origine e sul ruolo di due forme di erosione nelle argille: calanchi e biancane. Consiglio nazionale della richerche, Istituto di geografia dell'Università di Pisa.

Wagner, J. F. (2013). Mechanical properties of clays and clay minerals. In Developments in ClayScience (Vol. 5, pp. 347-381). Elsevier.

Wainwright, J., & Brazier, R.E. (2011). Slope systems. In: Thomas, D.S.G. (Ed.), Arid Zone Geomorphology: Processes, Form and Change in Drylands, third ed. Wiley & Sons, Ltd., Chichester, pp. 209–233.

Wang, H., Wang, S., Yu, Q., Zhang, Y., Wang, R., Li, J., & Wang, X. (2021). Ploughing /

zero- tillage rotation regulates soil physicochemical properties and improves productivity of erodible soil in a residue return farming system. Land Degradation & Development, 32(4), 1833-1843.

Waskom, R. M., Bauder, T. A., Davis, J. G., & Cardon, G. E. (2003). Diagnosing saline and sodicsoil problems (Doctoral dissertation, Colorado State University. Libraries).

Waskom, R. M., Bauder, T., Davis, J. G., & Andales, A. A. (2007). Diagnosing saline and sodic soil problems (Doctoral dissertation, Colorado State University. Libraries).

Watanabe, F. S., & Olsen, S. R. (1965). Test of an ascorbic acid method for determining phosphorus in water and NaHCO3 extracts from soil. Soil Science Society of America Journal, 29(6), 677-678.

Wise, S. M., SM, W., & JB, T. (1982). How Old Are The Badlands. A Case Study From South- East Spain.

Wood, C. A. (1980). Morphometric analysis of cinder cone degradation. Journal of Volcanology and Geothermal Research, 8(2-4), 137-160.

Wu, J., Li, H., 2006. Perspectives and methods of scaling. In: Wu, J., Jones, K.B., Li, H., Loucks,

O.L. (Eds.), Scaling and Uncertainty Analysis in Ecology: Methods and Applications. Springer, Dordrecht, The Netherlands, pp. 17– 44.

Xiang, J., Xu, Y., Yuan, J., Wang, Q., Wang, J., Deng, X., 2019. Multifractal Analysis of River Networks in an Urban Catchment on the Taihu Plain, China. Water, 11(11), 2283.

Xie, H., Wang, J. A., Kwaśniewski, M. A., 1999. Multifractal characterization of rock fracture surfaces. International Journal of Rock Mechanics and Mining Sciences, 36(1), 19-27.

Yair, A., Lavee, H., Bryan, R. B., & Adar, E. (1980). Runoff and erosion processes and rates in the Zin valley badlands, Northern Negev, Israel. Earth Surface Processes, 5(3), 205-225.

Yang, S., Jansen, B., Kalbitz, K., Castro, F. O. C., van Hall, R. L., & Cammeraat, E. L. (2020). Lithology controlled soil organic carbon stabilization in an alpine grassland of the

Peruvian Andes. Environmental Earth Sciences, 79(2), 1-15.
Zhang, T., Fan, S., Chen, S., Li, S., & Lu, Y. (2019). Geomorphic evolution and neotectonics of the Qianhe River Basin on the southwest margin of the Ordos Block, North China. Journal of Asian Earth Sciences, 176, 184-195.

Zhong, L., Xu, M., Yang, Y., & Wang, X. (2018). The development and evolution of landform based on neotectonic movement: The Sancha river catchment in the southwestern China. Journalof Earth System Science, 127(1), 8.

Zhou, Z. C., Gan, Z. T., Shangguan, Z. P., & Dong, Z. B. (2010). Effects of grazing on soil physicalproperties and soil erodibility in semiarid grassland of the Northern Loess Plateau (China). Catena, 82(2), 87-91.
Zuazo, V. H. D., & Pleguezuelo, C. R. R. (2008). Soil-erosion and runoff prevention by plant covers: a review. Sustainable agriculture, 785-811.

Appendix List

Appendix-A

Methodology of Isotopic study of Calcrete samples

The isotopic study was conducted in Birbal Sahni Institute of Palaeosciences (BSIP), Lucknow byIsotope Ratio Mass Spectrometer (CFIRMS, MAT 253). In this process, ~500-800 µg of calcrete samples as well as three carbonate standards (NBS 18, IAEA603 and Carrara marble) were kept into individual screw-capped glass vials. After flushing with He gas, 100% orthophosphoric acid (H_3PO_4) was injected into each vial which was kept at a 72ºC temperature bath for two hours. Theevolved CO_2 was purified by Nafion tube and Pora pack column in Gas Bench and allowed into Continuous Flow Isotope Ratio Mass Spectrometer (CFIRMS, MAT 253) for isotopic analysis. Each measurement comprised of three pulses of reference followed by six pulses of sample CO_2 gas. The tank reference gas was calibrated by using IAEA 603. All samples, including standards, were measured with respect to the calibrated tank gas. The isotopic data are reported against VPDBwith a precision of ±0.1‰ (1σ) for both $\delta^{18}O$ and $\delta^{13}C$ values.

The change in isotopic C-O concentration ($\delta^{13}C$ and $\delta^{18}O$) concentration was measured by the following equations:

$$\delta\, 13C‰ = \left[\frac{(13C/12C)_{Sample}}{(13C/12C)_{Standard}} - 1\right] \times 1000$$

$$\delta\, 18O‰ = \left[\frac{(18O/16O)_{Sample}}{(18O/16O)_{Standard}} - 1\right] \times 1000$$

Appendix-B

Methodology of the Standardized Precipitation Index

The Standardized Precipitation Index (SPI) was designed by McKee et al. (1993) to quantify the precipitation deficit for multiple time scales. The SPI is computed by fitting an appropriate probability density function to the frequency distribution of precipitation summed over the time scale of interest (usually 1, 3, 6, 12 and 24 months). These time scales reflect the soil moisture conditions of various time, dry and wet conditions throughout the year.

The SPI is obtained by dividing the difference between precipitation and mean precipitation (μ) by the standard deviation in precipitation (σ) in a specific duration (i). Mathematical expression of SPI is written as follows:

$$SPI = \frac{x_i - \mu}{\sigma}$$

This index help to workout water deficit year to a water surplus year. The drought conditions occurs when the SPI reaches negative values, i.e., SPI<-1 and the magnitude of SPI values indicates the severity of drought. SPI<-2 shows extreme drought, SPI value ranges from -1.5 to -1.99 indicates a severe drought conditions, moderate drought conditions depicts a SPI value rangesfrom -1.0 to -1.49; if the SPI value ranges from 0.99 to -0.99, shows a near normal conditions (Komuscu, 1999; McKee, 1995).

On the basis of above methodology, The SPI values were estimated with 50 years (1970- 2019) precipitation data that was collected from the India Meteorological Survey's Chitrakoot district rainfall station. The SPI calculation was carried out in the scale of short (3 months; SPI-3),mid (6 months; SPI-6) and long terms (9-12 months; SPI-9 and SPI-12) time scale, to estimate meteorological, agricultural and hydrological drought conditions, respectively. SPI-3 represents meteorological drought conditions, because meteorological drought takes the shorter time of prevailing water deficiency in the region. SPI-6 represents agricultural drought conditions, it is the average term drought considered of 6 months. Accumulation of water deficiency during crop in growing season generally takes three months, whereas most crops take six months to fully developcauses adverse impact on crop yield. SPI-9 and SPI-12 are two long-term drought indices (9 and 12 months respectively) are considered hydrological droughts. Hydrologic drought results from water deficiency of water storage in rivers, streams and other reservoirs.

Appendix-C

Indigenous species of vegetation helps to stop soil erosion

Vegetation types	Species	Local (Devnagri) name
	Apluda varia	Phuli
	Cymbopogon martini	Rusa
	Cynodon dactylon	Doob
	Desmostachya bipinnata	Kush
	Echinochloa colona	Sama
	Eulaliopsis binata	Sabai
	Heteropogon contortus	Kusul
Grass	Imperata cylindrica	Chhir
	Saccharum spontaneum	Kans
	Themeda quadrivalvis	Gunher
	Elymus repents	
	Calotropis gigante	Aak

	Argemone mexicana	Siarkanta
	Capparis aphylla	Karil
	Cassia auriculata	Tarwar
Shrubs	Lantana camara	Raimunia
	Carissa spinarum	Koronda
	Tribulus terrestris	Gokhuru
	Bombax malabaricum	Semal
	Azadirachta indica	Neem

Plants	Dendrocalamus strictus	Bamboo
	Prosopis juliflora	Khejri
	Bassia latifolia	Mahua
	Zizyphus jujuba	Ber
	Wrightia tinctoria	Dudhi
	Butea monosperma	Palas
	Acacia catechu	Khair
	Pongamia	Karanj

Appendix-D

The detailed description of various type of check-dams illustrated in the diagram in the givenbelow

(a) **Rock and woven wire check-dams-** These are low headed check-dams made up of local earthen and rock materials, which built across a small gully to restrict fine sediments. Theshape of the check-dam is crescent with the open end up stream with a random arc of curvature, but an off-set equal to 1/6th of the width of gully at the dam site is optimum. These check-dams can be suitable to all soil types (including cracking clays).

(b) **Brush dams-** Brush check-dams are made up of straw, thin stem, bamboo, mulches etc. The appearance of the structure is very much like a brush, so called brush dam. These damsare least stable, cheap, and most suitable in gullies of small drainage area. The centre of the dam is kept lower than the ends to allow water to flow over the dam rather than aroundit. The brush of the check-dam is generally made up of thin stem, and bamboo, which are closely packed together with bushes, and mulches for half of its height. Sides and bottom of the gully are covered with thin layer of straw or similar fine mulch for a distance of 3-

4.5 m along the site of the structure. Brushes are then packed closely together over the mulch to about one half of the proposed height of dam. Several rows of stakes are then driven crosswise in the gully, with rows 60 cm apart, and stakes 30-60 cm apart in the rows.To make the structure firm, all these wooden materials are tied together with heavy galvanized wire.

(c) Loose rock dams- Loose rock dams are generally constructed across small to medium sized gully with a smaller catchment area (less than 2ha), made up of small rock boulders.The prime objectives of these dams are to control channel erosion along the gully bed, andto stop waterfall erosion by stabilizing gully heads. Loose stone check dams are used to stabilize the incipient and small gullies and the branch gullies of a continuous gully or gullynetwork. Flat stones are best suitable materials for the construction of these check-dams.

(d) Log check-dams- The structure of these check-dams is also curved at the top. The primarybuilding material of these check-dams is wooden planks, heavy boards, and slabs, metallicpoles or old railroad ties. It has a rocky slope in the upstream side for the protection of theinternal erosion, and has an apron on the down slope side to dissipate the kinetic energy ofthe flowing water.

(e) **Boulder check-dams-** Boulder check-dams are built across the gully channels to provide stability to the gully channel. These are built with big boulders. These types of check-damsare recommended for complex gully systems, with multiple branches with a catchment areaof about 20ha, and a gully length of about 900m.

(f) **Drop spillway-** A drop spillway is a large concrete dike structure across a broad gully to restrict its flow and settle down fine materials. It has a weir structure at the middle, whichcontrols the over flow of water in the catchment area. The flow passes through the weir and discharge water to the downstream apron. Based on the shape of the opening, the weirs are rectangular, triangular, or trapezoidal shape. Drop structures are constructed from concrete, concrete blocks, gabion mattresses, steel sheets, concrete in sand bags, or timber.

(g) **Chute spillway-** Chute spillway is an open channel like structure, associated with a barrieror check-dam like structure which is constructed on steep slope of the gully face with a suitable inlet and outlet. The primary check-dam structure is made up of concrete or otherpermanent materials, depending upon the site feasibility and the cost involved. Chutes with reasonably large catchments need to be designed and constructed to avoid failure by undermining, overtopping or bypassing. For small catchments, a chute can be constructedto fit the existing gully and an individual design may not be necessary.

(h) **Drop-inlet spillway-** Drop inlet spillway is structured with inlet, conduit and outlet. The design consists of an inlet in the upstream side of the check-dam, which use to discharge excess water in the upstream side of the check-dam through conduit opening and outlet tothe downstream side. The main purpose of this system is to discharge water safely withoutbothering any damage to the embankment structure. The conduit is generally constructed with aluminium, aluminium coated steel, Concrete or steel pipe, with an inclination ofgreater than 10%.

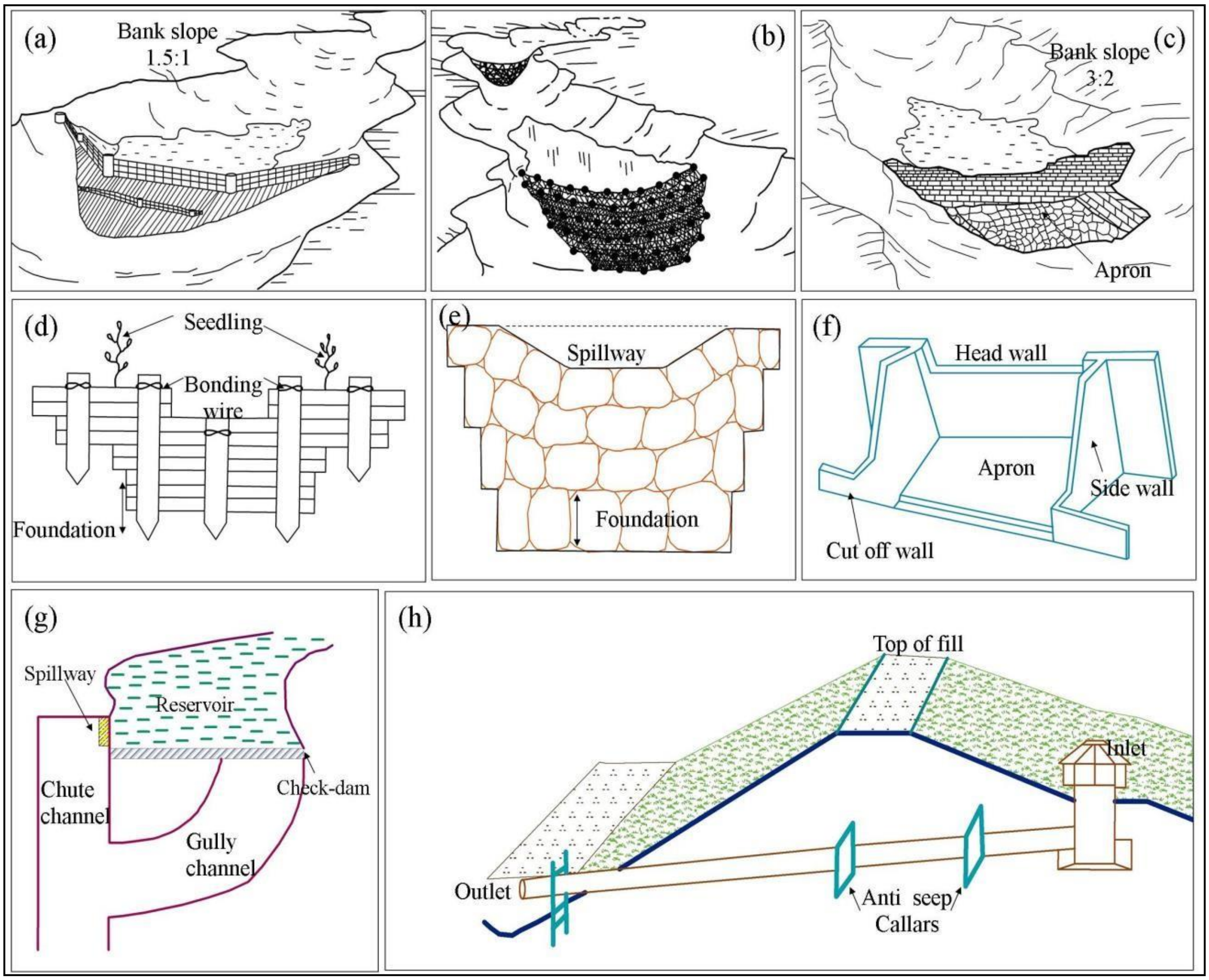

Diagram showing Temporary Gully Contentment Structure (TGCS) (a) Rock and woven wire check dam (b) Brush dam (c) Loose rock dam (d) Log check-dam (e) Boulder check dam; Permanent gully contentment structure (PGCS) (f) Drop spillway (g) Chute spillway (h) Drop-inlet spillway

List of Publication

Singh, N., Jha, M., Tignath, S., & Singh, B. N. (2020). Morphometric analysis of a badland affected portion of the Mandakini River sub-watershed, central India. *Arabian Journal of Geosciences*, *13*, 1-14.https://doi.org/10.1007/s12517-020-05405-8 IF- 1.83

Singh, N., Maddheshiya, S. K., Jha, M., Tignath, S., & Singh, B. N. (2020). Hydrogeomorphic assessment of badlands in part of the Mandakini River watershed, Chitrakoot, India. *Arabian Journal of Geosciences*, *13*(20), 1-17.https://doi.org/10.1007/s12517-020-06041-y IF- 1.83

Singh, N., Jha, M., Tignath, S., Singh, B. N., & Maddheshiya, S. K. (2021). Evaluation of neotectonic signatures and sequencing of morphotectonic events in the badlands of the Mandakini River watershed, Chitrakoot, India. *Environmental Earth Sciences*, *80*(12), 1-17.https://doi.org/10.1007/s12665-021-09716-1 IF- 2.78

Singh, N., Jha, M., Tignath, S., Singh, B. N., Chattopadhyay, A. (2022). Role of physico-chemical properties of the soil in the badlands forming processes around Chitrakoot, India. *Land Degradation & Development.*1-17. IF- 4.95

Singh, N., Jha, M., Tignath, S., Singh, B. N., Chattopadhyay, A. (2022) (Under review). Application of Multifractal Analysis in Identifying Badland Patterns and Processes: A Study of Mandakini River Sub-watershed, Chitrakoot, India. *Geoderma.*